

Mike Cristinzio  
Senior Seminar  
Professor Monheim  
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## Wholesale Nursery Design

### **Introduction**

This report is intended to research aspects of designing a wholesale nursery. Furthermore, this report will give information regarding the methods of production as follows; bare root, pot-n-pot, container, and field grown B&B. Lastly, this report includes information from those within the nursery industry through interviewing and surveying.

The main goal of this research is to design a wholesale nursery for Green Acres Nursery and Garden Center. In doing so, Green Acres hopes expand its buying power and overall size of the corporation, increase sales and sales diversity, and become self sufficient in supplying nursery stock. In stride with Green Acres's current mission statement and company philosophy, the wholesale nursery will promote quality and affordability. Also Green Acres will continue to strive for customer satisfaction to ensure customer loyalty and appreciation.

With the 30<sup>th</sup> anniversary coming spring of 2009, the company's future and success can be attributed to the hard work and dedication of all Green Acres employees, but special recognition must be attributed to the man who started it all, Robert Cristinzio. Without his passion and commitment, Green Acres and this report would not be what it is today. Therefore, this report and the future success of Green Acres Nursery and Garden Center and Green Acres Wholesale Nursery is dedicated to my dad, Robert Cristinzio.

### **History and Overview of Nursery**

A wholesale nursery produces and sells stock to other producers and retailers and not to the direct consumer. Furthermore, the direct function is to grow plants to a marketable size and to sell them in large quantities (13). Wholesale and production nurseries began in America soon after the arrival of Europeans. Nurseries primarily began in New York, Massachusetts, and other east coast states. In the beginning, fruit crops and vines were the first to be produced. As the nation was just coming into existence, ornamentals were not as important as the food crops vital for life. In 1737, Prince Nursery located in New York became the first commercial nursery. Prince Nursery would introduce and develop many new plant varieties to America (6).

Expansion of the nursery trade later developed after creation of the Erie Canal in 1825. This allowed for easy transportation via waterways and helped nurserymen increase their operations. Later in 1860, the arrival of railroads greatly expanded the nursery industry by reducing its reliance of waterways. Railroads also increased nurseries marketing potential by enabling salesmen and nursery stock to travel quickly to customers. Garden centers and retail nurseries would later come into existence around the 1920's with the creation and widespread availability of the automobile (10).

The US Plant Quarantine Act and US Parcel Post System were two crucial developments in 1912. The US Plant Quarantine Act helped the US nursery industry prosper by eliminating importing nursery stock from European nurseries. The US Parcel Post System helped by allowing nurseries to ship plants and was the main factor in the formation of mail order nurseries (10).

The current trend in the nursery industry has highly evolved. Ornamentals and specialty crops have taken precedence over fruit crops. Nurseries are currently becoming larger than ever before and just in PA, the nursery industry has revenue of about \$8 to \$9 billion dollars annually. The use of computers and other technologies has increased efficiency, productivity, and ease of management. Future research in the industry has been mainly in pesticides, plant growth, and irrigation technologies

(10). Lastly, the nursery industry's importance has ever so increase with the green and sustainable movement occurring in mainstream society.

## Site Selection

The site in which a nursery is built can be the single most important feature is determining success. Site selection can affect how and what types of plants can be grown, the amount and type of customers you will serve, and how the overall design and layout of the nursery will be. Tony Avent states, " The land you choose has an impact on virtually everything you do..." (3).

In general all wholesale nurseries have some general site selection characteristics. Unlike retail, wholesale nurseries should not be situated in a highly visible area. Although the site must be near or have access to major highways to the movement of deliveries. The site should have the capability to accept large trucks and general movement of daily operations (10). Furthermore, the nursery should be located in a close proximity to its market (1). The site selection will also affect the labor supply. Being one of the hardest aspects of running any business, labor supply should be researched prior to opening (1). Further research should be conducted to determine the previous use of the site. Doing so can help in determining current or future problems with the site. For example, if the site was used for farming the soil could be nutrient deficient and high levels of agricultural chemicals could be present. Both scenarios would lead to spending and time to correct (3).

The following is a general overview of site selection specifics for certain nursery production methods:

### 1. Bare root

The key feature in selecting a bare root nursery site is the friability of the soil. A highly sandy soil is desired because it allows for easy removal of the soil during harvesting. This

enables crops to be effectively transplanted without major root damage (10). The site should be large and continuous to allow for easy harvesting. This is beneficial because bare root nurseries sell in very large quantities. A continuous property allows for efficient harvesting and eliminates time spent of moving equipment and people (8).

## **2. Container**

The single most necessary factor in which all container nurseries require is water (1). If an appropriate supply and or quality of water is not available failure will quickly be met during the notorious dog days of summer. Therefore, when selecting the site to choose a container nursery be sure to hire a hydrologist to check both amount of water available for use and the quality of that water (3). It is suggested that the land should be able to supply a ½ to 1 in. of water per acre daily during the growing season. It is further suggested that water quality in terms of salt content should be carefully observed and should not exceed 525 ppm. Other quality concerns deal with the amount of heavy metal and micronutrient content in which little to zero is desired. Lastly, water pH is also important with a slightly acidic level is preferred (1).

Furthermore, a container nursery should have a sandy soil composition. This will aid in drainage of the site during heavy irrigation. To further assist in drainage and water movement, it is preferred that the site have a slight slope from ideally 1% to 5% (1).

Climate is another key environmental condition in container nurseries. It is generally advised that container nurseries avoid areas susceptible to heavy winds. This causes problems with irrigation, plant knockdown, and will effect the overall growth and quality of the plants. Many nurseries design windbreaks to help alleviate this problem. The general climate should be mild and areas of rapid and serve temperature changes should be avoided (1).

### **3. Pot-n-pot**

For the most part the land selection for a pot-n-pot nursery is very similar to that of a container nursery. Water supply and quality is also very crucial because of the high frequency use of drip irrigation. Drainage and slope is also very important to ensure high quality plants. Although still not preferred, wind and temperature changes can be more tolerated. The idea of placing the pots in the ground eliminates the problem of container knockdown and reduces heat and cold stress typically associated with container production (6).

### **4. Field grown B&B**

The most important factor when selecting a field grown B&B nursery site is the soil conditions. Prior to purchasing or deciding to start a B&B nursery a soil test or assay should be administered through the local county extension office. This will ensure that the nutrient, pH, soil texture, and possible pathogens in the soil (10). Furthermore, county soil maps should be consulted to determine the soil series consistent of the site (3). The site with a silt-like soil texture is desired because it enables the root balls to be durably formed and has good drainage to encourage root development. Clay soils should be avoided due to its poor drainage which reduces oxygen availability to roots. On the other hand, sandy soils should also be avoided due to its high friability. This makes it very difficult to form a well shaped root ball without it breaking (10).

The amount of organic matter is also a key issue with B&B nurseries sites. Since organic matter is essential in producing high quality and vigorous plants, and site with a high amount of organic matter is preferred. Steps can be achieved to increase both

organic matter and nutrients in the soil by planting a nitrogen fixing crop. Many legume crops like soybean or alfalfa can be used along wheat, rye, or sudan grass. By annually cover cropping the site and plowing into the fields, green manure is created and will increase organic matter content (10).

A slightly sloped topography is desired because it aids in air movement and water drainage of the site. Sites with slopes and hills can be used, but must be not be severe due to the need of large machinery. Lastly, the land should travelable and plowable (13).

## Layout and Design Features

Similar to the site selection of a nursery, the layout and design features can have a significant difference in the overall success. In general terms, a design should reflect a nursery layout that is efficient, manageable, and with ecology in mind. The further generalize space for production

### 1. Efficient

In a general sense, everything in any kind of business should be done in an efficient manner to increase profits. This idea applies directly to nursery design because the nursery should reflect an efficient work area to produce high yields at the lowest possible cost.

During the design process, locating production areas and support areas in close proximity increasing efficiency. For example, the media storage area and media mixer should be as close as possible. Furthermore, these two areas should not be far from the container production area. Doing so will eliminate the need for extra time and effort on moving nursery stock.

Loading and unloading areas should be large enough to allow large tractor trailers to maneuver. If possible, this area should be centralized near the main office. This will increase efficiency by making it easy to organize and record both incoming and outgoing deliveries. A staging area may

also increase efficiency by allowing orders to be pulled and grouped together. This is efficient because employees can work ahead in pulling orders and can do so at their own discretion. This is particularly helpful when outsourcing trucking. Relating to deliveries, the main roads at the nursery should be large enough and durable enough to support large trucks. Having a main road of at about 25' to 30' wide enables trucks to move with ease and supports two way lanes. Access roads to production areas should measure 10' to 12' wide and gravel is preferred. This enables machinery and small trucks to travel with ease to complete daily operations.

Other ways to design for efficiency involves the method of nursery rows for B&B production and pot-n-pot. These methods are as follows: Equilateral, Double Row, Standard Row, Square Row, and Staggered Row. Depending on crop, planned market size, and machinery size will effect the type and dimensions used for nursery row layout. The nursery row layout in which is chosen should be logical and planned for efficiency of harvesting and space. Labor costs can significantly be reduced by creating efficient nursery rows.

Since describing and visualizing row spacing methods can be difficult, attached chart 1A can be consulted.

**Equilateral** spacing is based on using diagonal direction to in lining the rows. This form is the most land efficient and allows for the most plants per acre (6). Equilateral spacing is more so efficient because it allows for four way access during harvesting. The disadvantage is that is extremely complex and difficult to layout. Due to its complexity it very infrequently used. (10).

**Double Row** spacing, as referred to as rectangle-square, is created forming two rows with a specific spacing between crops. Access roads separate the next set of two roads and are typically twice the distance of space between crops. This form of row spacing is used for specialty and specimen crops that need to be dug at small quantities. Digging and moving is extremely easy due to ease of access. Double row spacing is efficient because a cover crop can be grown simultaneously in

the access during production. By saving time the cover crop is preparing soil for future crops.

Drawbacks include low plants per acre and difficulties in changing crops cycles (10).

**Standard Row** spacing is the most commonly used method and is easily laid out. This spacing consists of straight rows with access roads between (10). Feeney's Wholesale Nursery used this spacing method most frequently in their production fields (11). Standard row spacing allows for alternating between crop rows and easy to layout. Disadvantage with standard row spacing is that it only allows for one access to cultivate and harvest (10).

**Square Row** spacing is another common type and is also easily laid out. Used for many container productions the distance between crops and rows are equal. This enables harvesting and cultivating in two directions. This method is very land efficient. Machinery size and maneuverability must once again be considered while determining spacing with the square row method (10).

**Staggered Row** spacing method is a hybrid between equilateral and double row spacing. Staggered row spacing will enable high end specialty crops to be grown at land efficiently while being easy to harvest and lay out. Using double rows for access and staggering the crops on each side of the rows staggered row spacing can be accomplished.

## 2. Manageable

Similar to efficiency, a nursery should be designed with how employees will carry out daily operations. Manageability is should be reflected in the irrigation and production areas. Additionally, employees must be further considered by allocating space for employee areas and main office areas.

Both irrigation and production areas need to be planned in a logical manner. Irrigation wells and areas should be centrally located within production areas. This increases ease of use and allows crops to be watered efficiently and properly. Production areas should be located on

the best sites of the nursery. Specifically field grown production, soil is key for success and crops should be grown in prime soil areas (6). An estimated 60% to 70% of land should be dedicated to production (1). Crops with similar cultural requirements should be placed together. This will make watering, fertilizing, and general care more manageable and efficient. Also crops can be produced at lower costs and at more optimum growing conditions (10).

Employee areas need to be designed with them in mind. Having heated areas with running water for employees to take breaks is a must. Also having bathrooms with running water is another feature employees enjoy. Parking must also be considered and should be located in proximity to main building. It should also be paved or stoned (10).

Sales and main office area should be attractive and easy to find (1). Signage and clear roads can assist in directing clients. First impressions are crucial in these areas and a well maintained area will help is overall sales (10). The sales and main office should be centrally located to add convenience for all employees (6). Lastly, the size of the area should reflect the size of the operation (10).

The nursery entrance also reflects a first impression to potential clients. Not only can this influence sales, the entrance can be and is a direct indication on the overall quality and output of the nursery. The entrance should be clearly marked with a well landscaped sign. It is advised to use plants grown on site especially those of specimen quality (19).

### **3. Environment**

Some important design features that concerning the environment and sustainability is detention ponds and the direction in which rows are created. Retention ponds are crucial managing storm water runoff and irrigation runoff (1). This water can be re-used for irrigation and is environmentally beneficial because it reduces the total amount water usage. If re-use is desire having narrow and

deep retention ponds is recommended because this allows excess salt content to be removed from water via settling (10). Retention ponds can also contain excess fertilizers and reduce the possibility of high nitrate and other harmful chemicals to leach into waterways. It is advised that a hydrologist is consulted when planning and designing the location of the retention ponds (3).

Also relating to the movement of water and runoff, the direction in which nursery crops are lined out has a major impact on sedimentation and erosion. It is suggested to line nursery rows perpendicular to the slope of the land. Doing so is very beneficial to the environment and nursery. Not only does it reduce sedimentation and erosion, but it will slow storm and irrigation runoff, and allow for a greater amount of water to be kept on site for plant growth. By construction nursery rows parallel with the slope channels are essentially created and will lead to greater erosion and sedimentation (6).

## **Government and Zoning**

Being similar to any business, nurseries do have to deal with governmental issues and zoning from the planning stages to daily operations of the nursery. According to Tony Avent, government continues to add nursery regulations at a rate more so than typical businesses. One federal agency that should be noticed is the Occupational Safety and Health Administration (OSHA). OSHA's main goal is to protect employees from dangers within the workplace. For nurseries, The American Nursery and Landscape Association's (ANLA) OSHA Compliance Manual is a great reference for understanding these regulations. Unfortunately for the green industry OSHA inspectors often fail to find immediate hazards in nurseries and similar agricultural industries, but still levy penalties on minor offenses. Most likely this is a method of job security (5).

Along with general tax all citizens must pay, nurseries and businesses in general are required to pay two additional taxes; the first of which is called sales tax. After nursery stock is sold, a state regulated sales tax is administered on a percentage basis (5). For example, in Pennsylvania the sales tax

is 6%. Although as a wholesale nursery, sale taxes can be exemption when selling to those other than the final consumer. To qualify to this exemption both you and your customers must file with the state department of revenue and receive a tax exempt certificate (5).

The second being unemployment tax of both the federal and state level. Together these taxes were designed to assist those who lost their jobs by no fault of their own. Unfortunately, Tony Avent quotes,

“ [Unemployment tax] is the most disgusting tax for anyone who has put forth the effort to start their own business, as it facilitates those who leech off your success when they claim unemployment compensation after they’ve been fired for doing a bad job” (5).

Federal unemployment tax equals 0.8% while the state tax ranges from 1% to 6% of your quarterly payroll amount.

The last governmental issue deals with zoning. Sometimes a difficult process ensuring that you land has the appropriate zoning must be obtained prior to nursery construction. Many times certain lands are restricted to a certain type of developing; ranging from agricultural, commercial, residential, or even industrial. For a wholesale nursery agricultural zoning is the best. Benefits include lower property tax, exemption from building permits, and amongst other legal protections. Your local zoning board controls all zoning issues and should be approached with any questions (3).

## **Production Types**

This section will give special attention the nursery production types of bareroot, pot-n-pot, container, and field grown B&B. This upcoming information was compiled through interviewing and surveying of members of the nursery industry. Attached are charts 2A and 2B which depict the aspects of field grown vs. container production and benefits and advantages of both types of production (9).

- **Bare root - J. Frank Schmidt and Son Co.**

J. Frank Schmidt and Son Co. are located in Oregon State and has a total of 3,600 acres under production. As a wholesale bare root nursery they produce over 500 varieties and cultivars of shade and flowering ornamental trees. As the creators of the Red Sunset Maple, amongst over 50 other patented plants, J. Frank Schmidt and Son Co. is considered one of the top bare root nurseries in the country (8).

Production manager Sam Doane has given information concerning the design of the nursery. Doane's experience with expansion of the nursery includes and new farm they developed eight years ago. Some challenges included finding a site with a large continuous piece of land with appropriate soil characteristics. After site selection, laying out the nursery to mesh with natural drainage patterns was a large challenge. Doane also states that finding sufficient irrigation water was another challenge during design and construction. When asked how he would improve the nursery, Doane stated that placing electronic control wires for automated irrigation system while installing the existing irrigation lines would have been beneficial. J. Frank Schmidt and Son Co. continually modernizing their nursery and sets the standard for others by participating in the USDA Specialty Crops Research Initiative. Doane describes that this organization allows nurseries to improve mechanization, automation, and computerization through grants. Furthermore, Doane states that by communicating with other nurseries, J Frank Schmidt and Son Co. frequently solve problems through a collaborative effort (8).

- **Pot-n-Pot – Hansen Nurseries and Tree The Streets**

Both Hansen Nurseries and Tree the Streets specialized in pot-n-pot production. Since Hansen Nursery in generalized has a container nursery particulars will be discussed later. Tree the Streets is a small pot-n-pot nursery that specializes in uncommon to the trade native trees. These trees grown by owner Tim Devaney, are usually transplant poorly when dug B&B due to

large taproots. Being a nonprofit organization, Tree the Streets plants native trees on public lands, parks, and other community areas (7).

According to Devaney, major maintenance and care problems with pot-n-pot production consist of root escape, watering, and lifting of the socket pot. Rather than using the popular root escape inhibitor Spinout Devaney suggests using a combination of latex paint and copper to eliminate root escape. He states it is more cost effective and easier to apply to the containers. The major problem concerning watering is both the availability and drainage of water. Devaney has added gravel underneath the socket pot to encourage drainage and discourage any pathogenic root problems. He has further managed the irrigation by using automated timers and emitters to allow only the required amount of water needed for growth. Devaney states that the irrigation system is extremely efficient and estimates that it only uses about five gallons of water per cycle. Another challenge Devaney stated was controlling weeds between rows. To solve this problem he used black plastic covering throughout the nursery to eliminate germination and growth of weeds. Lastly, Devaney recommended that when designing a nursery consult knowledge people within the field to help you understand the elements of nursery design and production (7).

- **Container- Hansen Nurseries and Lund Brothers Nursery LLC.**

Hansen Nurseries is located in Sassamansville, PA and is would be classified as a container production nursery. Have an extensive product line; Hansen Nurseries grows retail ready annuals and perennials, container shrubs and trees which consist of above ground and pot-n-pot production. Hansen supplies garden centers, landscapers, and other nurseries in the trade (12).

Hansen Nurseries has been in business for almost 60 years and is owned and operated by former PLNA President Frederick Hansen. Upon interviewing Hansen, he stressed the importance of over planning when designing a nursery. This means to plan slightly larger than anticipated and allow for both future expansion and plenty of room for movement. Also Hansen state that the biggest challenge in designing a container nursery is determining how to supply the amount of water needed for daily operations. He further stressed how planning must occur to develop methods of also removing surface and subsurface water to obtain good drainage. Hansen also stated the biggest challenges in maintaining the nursery is irrigation, fertility, and working with the weather. When asked how he would change or update his nursery Hansen responded with updating the irrigation system and increase the high of the overwintering structures. Lastly, if given the opportunity, Hansen would allocate more space for pot-n-pot production (12).

Lund Brothers Nursery LLC located in Hatfield, PA is both a container and B&B nursery. With a total of 14 acres under production Lund Brothers supplies local landscapers, nurseries, and garden centers in the Bucks and Montgomery county areas. The container product line consists of landscape ready shrubs and trees.

As only only being owners of Lund Brothers Nursery for a few years, Jeff.....and his wife ....., successfully manage the operation. They feel that both the irrigation system and cold frame layout should be redesign to help improve daily operations. Specifically they desire to have the irrigation pipes all buried underground and to increase the diameter of the supply pipes. Some challenges in maintaining their nursery is controlling weeds and eliminating deer damage. Jeff and (wife) have currently updated the nursery by purchasing a tree spade for easy digging of B&B stock. To conclude, they suggest that making a plan of the nursery should be designed even if you will only implement a small portion. So basically plan ahead and allow for future

growth. They further advise having the both the water quality and supply be tested prior to beginning of container production.

- **Field Grown B&B – Feeney’s Wholesale Nursery**

Feeney’s Wholesale Nursery located in Buckingham, PA is one of the premier nurseries within the area. Mainly growing B&B shade and ornamental trees, Feeney’s has about 500 acres in production. Specimen and buffer conifer trees are also grown on site. Feeney’s containerized trees and shrubs are purchased from other nurseries and are re-wholesaled to the trade (11).

After interviewing the owner Mike Feeney, I learned a great deal of information concerning B&B nurseries. Feeney stated that some of the challenges in designing a nursery is understanding the soils and how to use that information to determine what plants can be grown where. In addition, he stated that managing and controlling storm water is another issue. When it comes to maintaining the nursery his two largest concerns include deer and general labor costs. Furthermore, Feeney feels that “good to excellent” site selection of the nursery is critical. Like many other nurserymen interviewed Feeney would like to improve upon their irrigation system. Lastly, Feeney suggests that visiting nurseries and talking to owners is the best way to learn about nursery design and management (11).

## **Conclusion**

Designing a wholesale nursery can be a difficult and complicated process. With the continual improvements of best management practices in the nursery industry, this process can be further complicated. The best advice this report can offer is to go out and speak with nursery owners and operators prospering in the industry. Also go out and speak with those who do not have a good standing. Meeting with both types will increase your ability and concept of nursery design and will help

you decide what will work and what will not work for your operation. Simply put planning ahead, working hard, and managing properly will help you succeed in this challenging industry. Lastly have pride and passion in your work, your company, and in yourself.