Greenhouse Floors and Benches

Michael A. Schnelle
Assistant Professor
Extension Specialist
Floriculture and Ornamentals

John M. Dole
Assistant Professor
Floriculture

Choosing benching materials and designs can be a difficult decision, due to the wide choice of products available to the grower today. Listed below are common designs, materials, and considerations in choosing floors and benches for commercial greenhouses.

Floors

Standard Concrete

Regular concrete will endure about 2500 pounds per square inch. This mix is appropriate for heavy loads such as soil-mixing areas and locations in the greenhouse where heavy equipment is used. When possible, this formulation of concrete should be avoided for aisles in growing areas between benches, since it will not drain properly.

Porous Concrete

Porous concrete allows for drainage, will help prevent puddling, and still provides a barrier for weed control. Uniformly graded aggregate and cement water paste are needed to mix porous concrete. Although regular concrete is made with gravel or sand, no sand is included in porous concrete mix. Rather, mix one cubic yard of 3/8-inch diameter stone, 5 1/2 sacks of Portland cement, and 4 1/4 gallons water per sack of cement. When pouring this mixture, be careful not to tamp or compress the concrete, which will destroy the porosity needed for good drainage. Avoid using porous concrete in propagation/seeding areas, because soil particles will eventually clog the porous matrix and prevent even drainage.

Properly cured porous concrete will have a capacity to endure 600 pounds per square inch of surface. A four-inch floor of this mixture will adequately endure light vehicle traffic and personnel. Keep in mind that porous cement has one-fourth the strength of regular concrete, so do not exceed light traffic.

Gravel/Dirt

Gravel or dirt floors are inexpensive, but often not worth the initial savings. Gravel or dirt floors cannot be properly cleaned and disinfected, making it impossible to allow plants to touch the floors without the risk of transmitting diseases. Gravel or dirt floors will also harbor more pests. Floors will be chronically muddy with frequent irrigations and will generally appear unacceptable, particularly in retail operations. In fact, these muddy, unstable floors will be a liability because of the risk of customers falling and injuring themselves. Additionally, wheelchair bound customers will have a more difficult time maneuvering on gravel or dirt aisles.

A compromise to save money is to use gravel over dirt floors with concrete aisles. Many of the advantages of concrete floors discussed earlier can be realized but with a lowered expense, due to less concrete poured.

Floors as Benches

In some cases, it is advantageous to consider growing plants directly on the floor in conjunction with ground floor heating systems. Using the floor for growing plants is gaining popularity, but the cement must be laid exactly level in order to achieve an even distribution of water when flooding floors. Porous concrete floors may be expanded in width to serve as "benches." The main advantage is the porosity offered and the lowered cost from bypassing above ground structures. This system works well for some species. However, the added fatigue on employees may not be worth the initial savings when considering the strain of working at an awkward position.

When floors are being installed for specific purposes, it is wise to consult with qualified concrete contractors. They can advise and/or install the floor to your specifications. Porous or standard concrete will be used, depending on the specific roles the floor will serve.

Raised Benches

Bench Arrangements

Maximum utilization of growing facilities is largely based on the amount of growing area achieved (Figure 1). Benches in the peninsular design may result in a greater growing area than if they were in a longitudinal arrangement. The peninsular design also allows many species to be conveniently segregated, which can be a real advantage for retail growers. However, many growers have found routine tasks such as watering much easier on longitudinally placed benches.

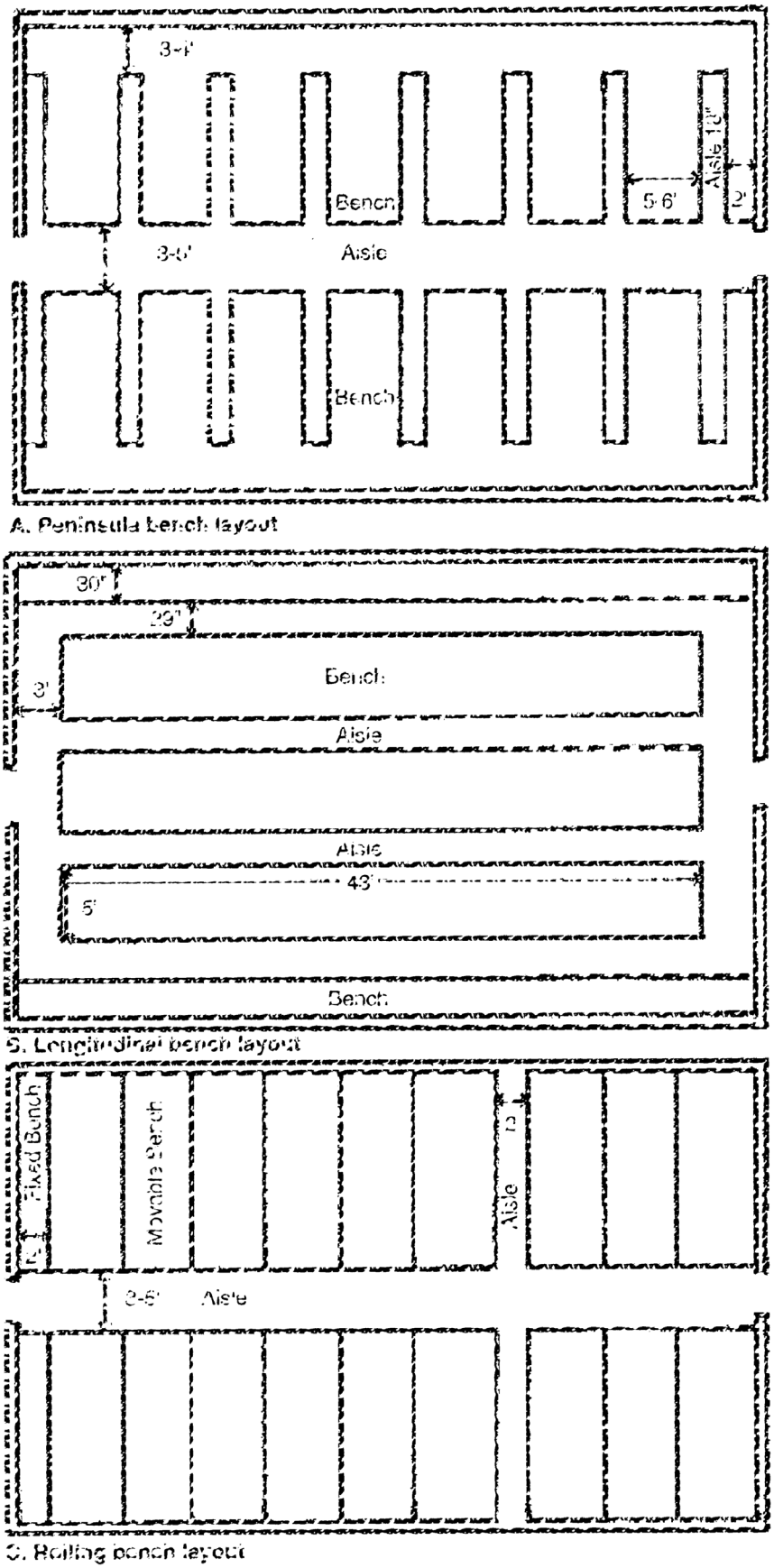

Figure 1. Greenhouse bench layouts. Design are intended for comparison only; exact dimension will vary with each greenhouse.

Lastly, non-stationery benches, which provide even more growing space, are gaining popularity with growers. Movable benches, known as rolling benches, can increase efficiency up to 90 percent of the floor space. Bench platforms are moved by a crank at the end of the bench from side to side. Some can be moved by hand by sliding the benches over the top of long steel poles. Aisles are created where the grower wants to work at any given time. Rolling benches are easy to move by practically any laborer, which is an added bonus. Movable benches, however, are not appropriate in a retail setting or where plants must be accessed frequently. Retailers are better served by staying with conventional benches such as the longitudinal, peninsular, or other comparable type designs.

Bench Space Efficiency

Benching efficiency is defined as the square feet of bench space to the entire greenhouse floor area. This number is expressed as a percentage.

Examples: A grower chooses a longitudinal bench arrangement in a greenhouse 30' x 80' or 2400 square feet of floor area. He decides to use 3-foot wide benches and 2.5-foot wide aisles and allows four feet at the end of the benches. The greenhouse has a benching efficiency of [5 (number of benches) x 72 (length of each bench) x 3 (width of bench)] \ (30 x 80 greenhouse dimensions) x 100 = (1080/2400) x 100 = 45%.

However, if the benches were widened to four feet and 74 feet long, allowing a three-foot turn around rather than four feet as before, efficiency could be increased to 49 percent [(4 x 74 x 4) / (30 x 80) x 100 = 49%]. To further increase efficiency, the benches could be widened and the aisle widths reduced.

If the grower looks at the same greenhouse with 2400 square feet floor space, but this time designs a peninsular bench arrangement, he will find that the peninsular design will increase the growing area even more. Still greater efficiency could be realized with rolling benches.

Benching efficiency could be increased even more by growing hanging baskets. Use caution in deciding what to grow underneath the overhead containers. Dripping will occur which may make some species unsalable under certain conditions. Overhead shelving, tiered benches and temporarily widening benches are additional methods to grow more with less space.

Bench Design

An alternative to conventional benching systems is the ebb and flow (flood or subirrigation) benches. Metal or wood benches are replaced with watertight, molded plastic trays. Trays are periodically flooded with water and desired fertilizer concentration, which can be taken up throughout the plants via capillary action. This system has such advantages as reduced and uniform applications of water and fertilizer. Excess water and fertilizer are collected after each flood and drain cycle to be recirculated later. Up to 50 percent reductions in water and fertilizer savings have been reported. Labor costs will also be reduced since the entire bench can be watered at the same time. This may not be feasible if plants with dissimilar water requirements are grouped together on each bench. An added benefit is that foliage will stay dry and plants can be grouped closely for greater production efficiency. Ebb and flow bench manufacturers have also designed trays to be incorporated into a rolling bench system for even greater versatility. This bench system should be given serious consideration with ever increasing restrictions on water and fertilizer runoff.

Materials for Benches

Regardless of the building materials chosen, benches normally do not exceed 36 inches high or wide when against a wall. Freestanding benches which are not against the wall may be up to six feet wide to allow workers to reach from either side. Freestanding benches should also not exceed 36 inches high to accommodate wheelchair bound clientele.

Allow air circulation for plants by having an open bench floor. This may be accomplished by a number of materials such as redwood, lath, 14 gauge welded wire fabric, or expanded metal. Be certain enough rigidity is offered to prevent sagging and toppling pots. Regardless of materials chosen for bench construction, a good rule of thumb is to allow support for at least 25 pounds per square foot area.

Wooden Benches

Locust, cedar, redwood, and cypress are all woods highly resistant to decay. Paint benches before use with copper naphthenate or other preservatives (known to be safe around plants) to augment the natural decay resistance of the wood chosen. When redwood is chosen, iron and steel will corrode from naturally present decay inhibitors. Therefore, choose metals such as aluminum, zinc, or brass nails, screws, and bolts. Benches may be all wood or in combination with a different material for the base. Often, expanded metal or welded wire of one inch or smaller mesh are used. While expanded metal is more expensive, it does not sag like welded wire. Besides decay, wood may warp and often absorbs soils, chemicals, etc. which cannot be adequately removed. When wood is chosen, higher maintenance will be required on a regular basis.

Concrete

Some growers have built concrete forms and poured entire benches, including the legs (supports), all at once. These benches are permanent and do not allow for change later. Concrete benches are durable and will not require additional treatment to prevent decay such as with wood. They may be reinforced with steel rods, when poured, for additional durability. Lastly, consider drilling holes in the base of the bench for proper drainage.

Metal

Entire metal or steel benches are used alone or in combination with another material. Advantages of galvanized metals over wood are the longevity and resistance to rot and decay. Metal benches may be expensive to install initially, but can be considered a one-time cost. Also consider the lowered maintenance costs when these types of benches are used.

Temporary/Portable Benches

Plastic

Although plastics are becoming more common for bench beds, plastic frames are not always desirable. They are often not as durable or able to support as much weight as other benching materials. However, in a retail setting, prefabricated benches can be purchased which are lightweight and, thus, portable. These are also available mounted on rollers, making them particularly convenient in retail settings. Also, maintenance on plastic benches is again considerably less than for wood.

Pallets

Another portable bench system can be inexpensively constructed by placing pallets on cement blocks for support. Besides the low cost, this portable display can be easily and quickly disassembled.

Bench Supports

Cement blocks are commonly used to support bench tops, particularly if they are not intended to be permanent. Permanent benches may also be supported in this fashion. Additionally, steel poles are often used for bench support. Plastic bench supports are becoming more popular, but again they are often not as strong, and in many cases are most appropriate for temporary retail displays. When wooden supports are used, it is especially critical to chemically treat them for decay, at least the area which will be submerged in the soil. The same preservatives which may be used on the growing surface of the benches are appropriate. Also, by pouring concrete footings, the structural integrity of the bench supports may be reinforced.

Purchasing/Building Benches

Benches may be built to suit ones particular needs, or an array of prefabricated benches may be purchased and installed by the distributor. Besides bench frames, bench fabrics made from metal, plastic, etc. are readily available from greenhouse supply companies.

Bench System Supply Companies

American Plant Products and Services, Inc.
9200 N.W. 10th Street
Oklahoma City, OK 73127
(405) 787-4833

AQUA-HORT SYSTEMS, INC.
P.O. Box 57197
Oklahoma City, OK 73157
(405) 521-8002 US: 800-446-1694

Growers Intl. Inc./Div. of Sharp & Son, Inc.
P.O. Box 10
Schulenburg, TX 78956
(409) 743-6522

Growing Systems, (M,W)
2950 N. Weil
Milwaukee, WI 53212
(414) 263-3131

Metalex, Inc., (M)
1530 Artiaus Pkwy
Libertyville, IL 60048
(312) 362-8300 US: 800-323-0792

Nexus Greenhouse Systems Corp., (M)
10983 Leroy Dr.
Northglenn, CO 80233
(303) 457-9199 US: 800-2-BUY-NEX Fax: (303) 457-2801

Rough Brothers
P.O. Box 16010
Cincinnati, OH 45216
(513) 242-0310 OH: 800-543-7602 US: 800-543-7351
Fax: (513) 242-0816

Sharp & Son, Inc.
900 Lind Ave. SW
Renton, WA 98055
(206) 235-4510

Westbrook Greenhouse Systems, Ltd. (M)
P.O. Box 99
Grimsby, ON Canada L3M 4G1
(416) 945-4111 US: 800-263-0230 Fax: (416) 945-6564

Structural Plastics Corp.
2750 Lippincott Blvd.
Flint, MI 48507
(313) 743-2800 US: 800-523-6899 Fax: (313) 743-2799

Dramex Intl., (M)
20 Fasken Dr.
Rexdale, ON Canada M9W 1K5
(416) 675-6311 Fax: (416) 675-4310

B & C Mortensen Wood Products
Rt. 4, Box 1000
Oldtown, ID 83822
(208) 437-5665

Barlow Tyrie, Inc., (M)
1263/230 Glen Ave.
Moorestown, NJ 08057
(609) 273-7878 US: 800-451-7467

Southeastern Wood Products Co.
P.O. Box 113
Griffin, GA 30224
(404) 227-7486

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