BioChambers
PROVIDING GROWTH TO RESEARCH.

FREQUENTLY ASKED QUESTIONS

with Dr. Patrick Friesen

FAQ QUESTION #1

What should I consider when purchasing one or more new growth chambers or rooms?

Step 1: Determine chamber or room series based on plant species, growth stage/plant size, and research/application needs

The first things to consider are the plant species, maximum growth stage, and plant size you will be working with. These factors will help determine the required growth height and light intensity (Photosynthetic Photon Flux Density, PPFD). Our growth chambers and rooms are categorized by your required plant growth height: tall plant (TP series), flex (FX series, tall and short plant), short plant (SP series), tissue culture (TC series), and seed germination (SG series). For example, if you're only growing large maize plants to later growth stages (tall growth height, high PPFD), you'll need tall plant chambers. If you're only growing *Arabidopsis* (lower growth height, lower PPFD), you'll need short plant chambers. If you're growing large maize plants and *Arabidopsis*, perhaps consider our flex chambers (Figure 1).

FIGURE 1: FXC-19

PPFD capabilities can be another important factor in deciding which equipment series you need. Tall plant series generally have higher PPFD capabilities on their single tier lighting arrays compared to multi-tier lighting arrays in short plant series. Do you need to match PPFD for research purposes or quickly grow large plants? Most plants can grow healthily under a wide range of PPFD, however some plants like maize require higher PPFD to thrive. Other plants like *Arabidopsis* are routinely grown at lower PPFD for safer and reproducible growth for comparative purposes. Most often total plant height, from the bottom of the pot to the top of the plants, is the most important determining factor for equipment selection. However, even with taller plants such as maize, if your research or application only requires growth to the second or third leaf stage, short plant or flex chambers may be suitable for your application. Here with multiple shelves/tiers you'll have more growth area and be able to grow more plants. Tissue culture is a special application requiring lower PPFD, growth height, and air flow up from the shelf to reduce condensation in petri dishes (Figure 2). Seed germination is another unique application, generally requiring even lower PPFD and growth height than tissue culture equipment, and high humidity.

FIGURE 2: TISSUE CULTURE

Temperature control range is the next decision to make in choosing your equipment series. The standard temperature range for most equipment is 10 to 35°C lights on, and some have the option of extending the upper temperature limit to 45°C. If you require sub-zero growth temperatures, our low temperature equipment (LT series) can achieve -10°C with the lights turned on.

Once you've determined which chamber series you need, think about any options you'd like to add to your new equipment. Are standard temperature and PPFD controls sufficient, or do you need humidity and/or CO_2 control as well? For more information on how environmental conditions inside your growth chamber can affect plant growth, please read FAQs 2-9.

Step 2: Determine total growth area and number of unique environments required given the available space and budget

Total required growth area and number of unique environments are the next factors to consider. With one exception (SPC-7-2H), all other chamber or room models are single environments where temperature, humidity, and CO_2 concentration are homogeneous across the entire chamber or room. PPFD can be differentially controlled in some equipment under different light canopies. The number of independent environments is important to consider when designing experiments with growth chambers and rooms; for more information on experimental design please read FAQ 11. To determine the number of replicates or sample sizes for your experiments, determine the number of plants that will comfortably fit on a each shelf of a given chamber or room. For example, a 30" x 48" shelf can comfortably accommodate 4 *Arabidopsis* trays (10.75" x 21.25", 3 x 6 = 18 pots/plants per tray x 4 trays = 72 plants per shelf). Finally, to determine the total number of plants possible in a particular growth chamber or room, multiply the number of plants per shelf by the total number of shelves within a given model. After you've determined your growth area and unique environment requirements, the next step is to assess the installation space and make a layout to decide which reach-in chamber or growth room models you'll need. Making best use of the installation space may require growth chambers whose chamber footprint matches the growth area it provides (Figure 3).

Key questions to think about:

- How do I make best use of the space?
- How much growth area do I need?
- How many independent environments do I need?

When designing new buildings, consider the floor space and height requirements (including assembly height) of the growth chambers and rooms you will install inside the allotted space. For existing buildings, please make sure you have the floor space and ceiling height required for a given growth chamber or room. Keep in mind that a growth chamber's footprint requires additional clearance for door swings and service access. Another consideration is the existence and location of floor drains, necessary to drain water from plant care and the condensation drip from refrigeration equipment. Finally, the overall layout of a growth chamber facility should consider the workflow and requirements of the workers to most efficiently and safely use the space.

FIGURE 3

Common questions to ask yourself:

- Will the carts we use to move plants and/ or equipment comfortably fit through the aisles and turn corners?
- Can a cart or person comfortably pass another cart in the aisles?
- How important is this?
- Will plants from one chamber be routinely moved into another chamber?
- If so, is it easy to move plants between these locations?

Other factors to consider when purchasing new equipment:

a) Ability to move largest growth chamber component into installation space

Most of our reach in growth chambers split into two or more large sections and are designed to fit through a standard 915mmW x 2030mmH (36”W x 80”H) doorway. It is critically important that the largest chamber section fits through doorways, into elevators, down hallways, and around any corners it travels through before reaching its final installation location (Figure 4). Please contact us for the dimensions of the largest chamber section.

FIGURE 4: IT PAYS TO PLAN AHEAD!

b) Noise

Growth chambers and rooms make noise when they are running, mainly due to the compressor which is part of the refrigeration system. Consider noise if growth chambers are to be installed inside lab spaces where people are routinely reading or doing focused lab work.

c) Network connections

The ability to connect growth chambers and rooms to the local area network and internet allows users to remotely monitor and control the equipment. In addition, network connection allows BioChambers technicians to remotely troubleshoot and diagnose chamber issues, minimizing chamber down time. If at all possible, please ensure a network connection (Ethernet) to our equipment.

d) Electrical

All of our growth chambers and rooms require 3-phase power apart from our smallest models. Each chamber and room has unique electrical loads, so it is important to confirm that the installation space has the electrical capacity to power your new equipment.

e) Chilled water

Having access to chilled water is an efficient and cost effective way to remove heat from the cooling systems of larger growth chambers and rooms. If chilled water is not available, excess heat will need to be removed through a remote air-cooled condenser or condensing units. Remote air-cooled condensers/condensing units add to equipment cost and occasionally require building modifications to route piping; these units are located outside the building, often on building roofs. Some smaller growth chambers can be equipped with self-contained air-cooled condensers that exhaust excess chamber heat directly back into the spaces where they are installed. In these cases it is important to confirm that the building HVAC system has the capacity to remove this heat to prevent the space from warming up to uncomfortable temperatures.

For a more detailed discussion of condensers and how to select the best option for your situation, please read: Condensers: Guidelines on Choosing the Correct Type for Your Application. (https://www.biochambers.com/pdfs/condenser.pdf)

f) Ability to supply other utilities and consumables for certain chamber options including:

- Supply of de-ionized or reverse osmosis water at a pressure between 4.1bar and 6.9bar (60 and 100psi) for additive humidity options
- Ducting for chambers equipped with desiccant dryer dehumidification system
- Compressed air for certain additive humidity and defrost options (low temperature chambers/rooms)
- Source of CO_2 for additive CO_2 control options
- Sofnolime or Sodasorb for chambers equipped with CO_2 scrubbing options
- Irrigation water for chambers equipped with auto irrigation
- HEPA filters for HEPA filtration

Our goal is to ensure you have the best equipment for your plant growth goals, and we are here to work with you every step of the way. Ultimately, we aim to ensure our equipment meets or exceeds your expectations and is reliable for many years.

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