



April 2006 Station Report to NCR-101, Controlled Environment Technology and Use

Peter Vanderveer, University of Wisconsin Madison Biotron

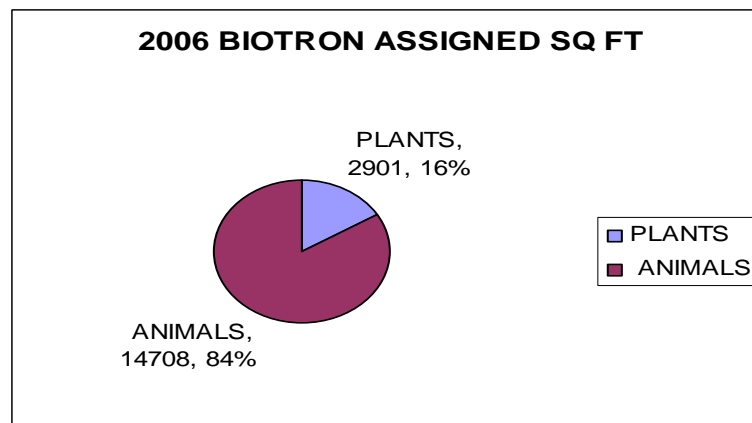
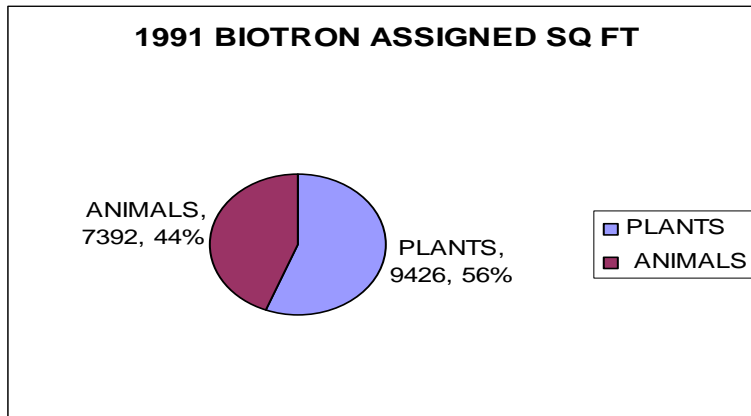
Jiwan Palta, University of Wisconsin Madison Horticulture Department

The University of Wisconsin Biotron has upgraded several aspects of operation. They are listed below. I have also compiled some data on the Biotron that may be of interest to NCR members.

- Phase 1 has been completed involving utilizing new computers and LABVIEW™ software for the environmental control system. We have started Phase 2 which involves replacing the bus and control cards that send commands to the valves, pumps, relays etc that control the temperature, relative humidity and lighting in the control environment rooms. Has been delayed until central campus conducts an energy audit of the Biotron. We have tested the National Instruments components and will decide between 3 options once the energy audit has been completed.
 - Labview™ software control coupled with National Instruments components.
 - Johnson Controls Metasys software control with Johnson Controls components (we currently are using Johnson Controls software and hardware for control of the 29 A/C greenhouse rooms and Biotron control environment super cold rooms.
 - Labview™ software control coupled with rebuilt existing control cards and new power supplies, relays, pumps, valves etc.
- The University of Wisconsin-Madison has begun installation of a centralized campus access control system (CCAS) based on the ContinuumT security management system from Andover Controls, Inc. Biotron has been assessed for this system upgrade and we are waiting for the cost estimate to be prepared.
- The hyperbaric chamber has been upgraded to handle gas monitoring and mixing. Oxygen enrichment, CO₂ monitoring/scrubbing and better relative humidity and temperature control have been added plus data logging (pressure, time, temperature, relative humidity, gas concentrations etc). The system has been tested and used successfully for experiments.
- Biotron has just starting using/evaluating HOBO™ data loggers/sensors for checking/verifying temperature, relative humidity, lighting and CO₂ measurements. Our initial impression has been favorable. Data loggers are user

friendly, easy to download onto a computer via USB ports and imports to MS-Excel. Accuracy seems better than stated by HOBOtm, temperature 0-50^oC ($\pm 0.35^{\circ}\text{C}$) and relative humidity 10-95% RH ($\pm 2.5\%$ RH). The light data loggers/sensors are being used to verify that lights are turning being commanded on and off. CO₂ data logger/sensor is yet to be used. HOBOtm markets many other products that would have relevance for the control environment field.

- ENERGY, ENERGY, ENERGY** The Wisconsin Energy Initiative project was completed in 2004 at the Biotron. The State of Wisconsin partnered with Johnson Controls to look for energy savings at state and university buildings. The Biotron project involved spending \$375,000 for energy upgrades which would potentially save \$37,500 a year, pay for the initial investment in 10 years. We do not have data from Johnson Controls yet on energy savings but our electric use went up 1.3% last year. Biotron energy consumption is gaining attention and campus physical plant has scheduled an internal energy audit within the next few months. Last year we consumed 6,714,000 kilowatt hours of electricity at \$.05341/kilowatt hour for a total of \$358,594. Our total energy bill was about \$813,000. The Biotron ranks 5th on campus for electric use but 1st on a sq ft basis. We use 62.8 kilowatt hours per sq ft, the 2nd building on campus uses 50.04 kilowatt hours per sq ft. Campus has set goals to reduce energy use by 20% next year. This is driven by the state of Wisconsin capping the campus energy budget.
- Occupancy trends:**



The completion in 1996 of 29 air conditioned greenhouse rooms totaling 6288 sq ft and 2633 sq ft of support space has allowed more Biotron rooms to be assigned for animal projects. However, most plant investigators prefer using greenhouse space. The remaining control environment rooms within the Biotron that are configured for plant research continue to be underutilized.

Charge back/Budget Trends:

Item	1991	2006	%
Plant Std Room	\$14.06	\$17.85	+27%
Animal Std Room	\$14.06	\$17.95	+28%
High Light Room	\$28.12	\$19.95	-29%
Hypobaric Chamber	\$63.50	\$82.72	+30%
Plant Occupancy	unknown	68%	?
Animal Occupancy	unknown	100%	?
Income	\$167,234	\$481,376	+188%
Grad School Subsidy	\$534,261	\$177,019	-67%
Full Time Staff	20.3	10.25	-50%
Application Fee	\$100	\$0	-100%

Current charge back rates for university research projects are \$0.175/sq ft for control environment plant rooms, \$0.176/sq ft for control environment animal rooms and 0.057/sq ft for air conditioned greenhouse rooms. The charges for plant projects include all supplies. The charges for animal projects include cage washing and bedding. Investigators provide cages and labor for cage changes and health checks. Our income is derived from 9% private industry, 17% plant projects/material testing and 74% animal projects.

COLLEGE OF AGRICULTURE AND LIFE SCIENCES UPDATES

New Glass Houses: Major remodeling and construction of new glass houses was completed in July 2005. A total of 32 houses (each 500 sq. feet) have been constructed. They have air conditioning and 20 high pressure sodium lamps in each house. Computer controlled electronics turn on lights on demand. Each house has a high powered fan for air intake equipped with a very fine screen to screen out insects. The

facility is running very well although it is lot more expensive for the researchers to rent this space as compared to the old facility. Despite the cost increase the facility is well occupied.

Remodeling and move of growth chamber facilities: Two walk-in growth chambers that were housed in the basement of Biochemistry / Molecular Biology have been moved to the basement facility of the Horticulture. This move was to accommodate the need to build a Frog- Facility in the Biochemistry. However the move allowed for the Horticulture to relocate a walk-in chamber in the Biochemistry basement which is designed to operate down to -15 C. This move also allowed for the Horticulture Department to install a new large walk-in chamber used for growing Arabidopsis. This move forced us to discard four old plant growth chambers (reach-in). All in all we have added new plant growth chambers and they are all working well. The funds for the move were provided by the Biochemistry Department. Funds for several new chambers have come from various federal grants. We are currently using the new chambers to conduct research on chilling and freezing tolerance of potato genotypes. Research is also underway to study the interaction of root zone Ca and GA on tuberization in potatoes. In this research we are utilizing a constant drip and inert silica system to maintain various levels of Ca and GA in the root zone. The system is similar to the one used in Ted Tibbitts` s program for growing potatoes. We hope to share some data from these studies at the NCR-101 meetings next year.