



Growth chamber facilities in the Martonvásár phytotron

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What are phytotrons

Phytotrons (compound greek word: phyto=plant; tron=small house) are the most **complex form of controlled-environment facility**. Generally artificially and sometimes naturally lighted, controlled-environment rooms and/or cabinets are used in conjunction with incubators, seed germination chambers, photoperiod rooms and mechanically-refrigerated greenhouses, etc. to provide a multiplicity of environmental conditions.

A plant growth chamber should fulfill the following requirements:

- precisely reproducible environments
- uniform controlled climatic conditions over the entire growth area
- conditions are suitable to the healthy development of plants and seeds

In phytotrons wide range of environmental factors can be studied simultaneously.

The advantages of larger amount of climatic chambers

Phytotrons have an operating staff of specialists to maintain the system (here in Martonvásár 4 electricians, with permanent, 24 hour inspection) and the experimental material (this staff consists from 2 people). **Scientists**, therefore, **could concentrate on research** rather than maintenance and operation of equipment.

Phytotrons also make **efficient** use of controlled environment space, since they **receive steady use without periods of inactivity and the downtime** due to malfunctions.

Phytotrons are used primarily to investigate how environment controls and modifies plant growth and development, but they are used also to complement and supplement field and greenhouse research in areas like **plant breeding and introduction of new plant species and varieties**.

Phytotrons also play an important role in many phases of ecological research. Since plants can be grown and developed in phytotrons at strictly controlled conditions and with chemical compositions, that match definitions of “normal” **they allow detailed study of the physiological and biochemical systems affected by climatic stress**.

Phytotrons are an efficient method of managing controlled-environment facilities, whether they **are used as plant growth chambers to provide constant, reproducible conditions** for genetical, physiological and biochemical studies or for research like **simulation modeling** which virtually requires simultaneous use of a wide range of several environmental factors.

The short story of the Martonvásár Phytotron

- The idea of establishing was born in 1959
- The negotiations with major companies manufacturing climatic plant growth chambers were held in late sixties (1966-)
- In 1970 a contract was signed with the Canadian firm Controlled Environments Ltd. (CONVIRON; www.convirion.com) for manufacture and delivery of (at first) 44 mechanically (analogue) controlled phytotron units
- The construction work began in spring 1971
- The official opening ceremony was held on November 3, 1972
- In 1989-1990: reconstruction by CONVIRON, with computer (digitally) controlled phytotron chambers
- 2006: reconstruction of 3 GB-48 chambers by Fitoklíma (Hungarian firm – representative of Conviron in Central-Europe)

Some technical data

- **The climate of practically any part of the Earth where vegetation exists can be simulated in reproducible programmes with temperatures ranging -25°C to $+45^{\circ}\text{C}$.**
- **50 plant growth and testing units**
- **12 PGV-36 type autumn-winter chambers**
- **16 PGR-15 type spring summer cabinets**
- **6 PGB-96 type plant growth benches**
- **6 GB-48 type growth benches**
- **2 C-812 type cold rooms**
- **5 G-30 germination cabinets**
- **2 TCL type tissue culture chambers**
- **1 gradient chamber**

The following parameters can be controlled

- Temperature: from -25°C to $+45^{\circ}\text{C}$
- Relative humidity to 80% - depending on temperature
- Illumination: max 40,000 lux
- CO_2 concentration
- UV-B radiation

Technical parameters of the phytotron units

Phytotron unit		No.	Growth		PPFD	Temperature (°C)	
Designation	Type		area	height		min.	max
<i>Before reconstruction</i>							
Autumn-winter chamber	PGV-36	12	3.3	2.4	500	-5	40
Spring-summer cabinet	E-15	12	1.4	1.8	500	5	40
Spring-summer cabinet	E-15VH	4	1.4	1.8	1000	5	40
Growth bench	GB-48	14	4.3	2.8	325	15	35
Cold room	C-812	2	7.1	0.5	-	-20	20
Gradient chamber	GRD-01	1	3.3	1.5	400	5	35
Germination cabinet	G-30	5	1.5	0.3	65	4	40
Vernalisation chamber	J-01	1	13.5	0.4	10	2	20
<i>After reconstruction</i>							
Autumn-winter chamber	PGV-36	12	3.3	1.9	600	-10	40
Spring-summer cabinet	PGR-15	16	1.4	1.8	600	4	45
Growth bench	PGB-96	6	9.0	2.6	500	10	40
Growth bench	GB-48	6	4.3	2.8	325	15	35
Cold room	C-812	2	10.8	0.5	-	-25	20
Gradient chamber	GRD-01	1	3.3	1.5	400	5	35
Germination cabinet	G-30	5	1.5	0.3	65	4	40
Vernalisation chamber	J-01	1	13.5	0.4	10	2	20
Tissue culture chamber	TCL	2	25.0	0.3	90	20	30

*Photosynthetic Photon Flux Density



The phytotron hall



The regulatory unit



The PGV-36 autumn-winter chamber



The PGR-15 spring-summer cabinet



The PGB-96 growth bench



The GB-48 growth bench



The C-812 cold room



The GRD-01 gradient chamber

NYC - Status

Alarm Quiet

Oct 29 15h31 4

Loop Status — ILC: 3780-00-1.31 — Loop Number: **[11]** **[1]**
00 01 02 03 04 05 06 07 08 09 10 11**[12]**13 14 15 16 17 18 19 20 21 22 23 24
25 26 27 28 29 30 31 32 33 34 35 36 37 38 42
80

Alarms — Les 12: 3244-2.54-1.2

07:04 09/01 Local alarm triggered 1	18:09 09/21 Disconnected
09:46 09/13 Disconnected	18:09 09/21 Connected
09:47 09/13 Connected	12:09 09/26 Disconnected
10:29 09/15 Disconnected	12:10 09/26 Connected
10:30 09/15 Connected	17:14 09/29 Disconnected
07:28 09/19 Disconnected	17:14 09/29 Connected
07:28 09/19 Connected	21:59 09/29 Disconnected

Les Status

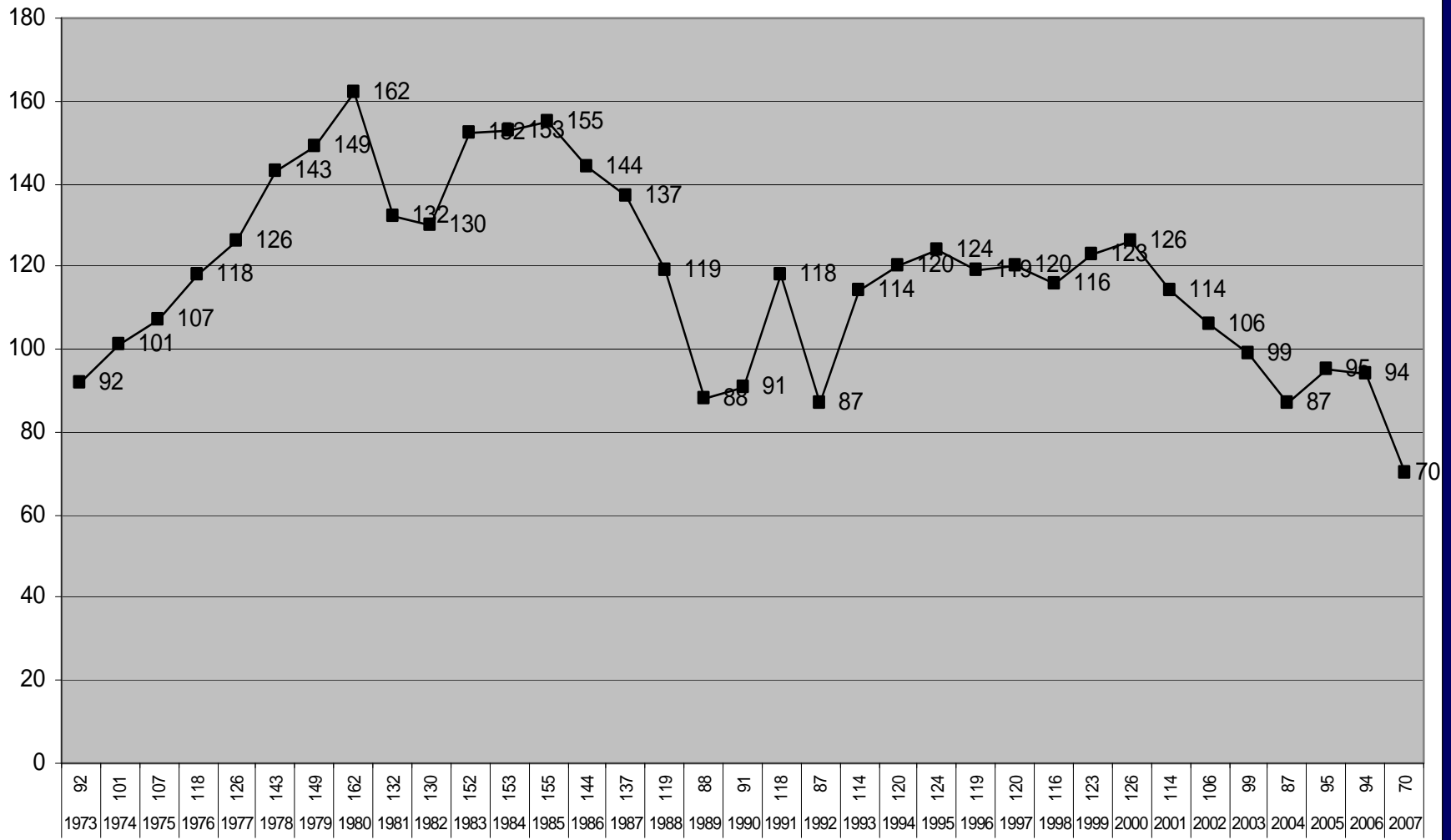
Time : 15:29	Temperature: 09.9°C	Rh: 74%
Light Banks On: 3 Fluorescent 0 Incandescent	Mode : Sun	
Auxiliaries : 1-off 2-off 3-off	Keyboard : Authorized	

Note Alarms Suspend Warn Acknowledge Delete Remove
Acknowledge all alarms at all less

TVS

The QNX control system monitor

Number of experiments carried out during 1973-2007



**Total no. of experiments: 4131; Yearly average: 118;
Average net utilization of the phytotron capacity ranged from 60-70 %**

The phytotron cooperates indirectly in the creation of **new varieties**, in the elaboration of **new agronomic techniques** and in the solution of **basic research problems** in physiology and genetics.

Enumerating of results should be mention the **methodological research** (i.e. climatic program elaboration) and the **technical development** existing continuously in the past 35 years in the phytotron.