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Phytotron: An Unrecongnised Masterpiece

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One of the most compelling trons was in plant biology. These were giant computer-controlled environmental laboratories called "phytotrons" which were later built all around the world. Frits Warmolt Went (1950) suggested the name "Phytotron" — *phytos* from the Greek word for plant and *tron* as in cyclotron, a big complicated machine (Munns, 2014). For plant scientists, the controlled environmental conditions granted the creation of the phytotron which was important because the growth and development of any organism depends only on its genes and its environment. They required the ability to produce reproducible climates in order to conduct experiments that tested plants responses to various environmental conditions.

A phytotron is a facility enclosed with a number of growth chambers and greenhouses which are predominantly organized for studying different interactions between plants and the environment factors in such a way that they can be simulated for research studies simultaneously. It was a product of the disciplines of both plant physiology and botany. Phytotron provides all services necessary to conduct many types of controlled environmental experiments, from the simplest to the most complex and it also claims to have total control of the whole environment (Ronde and Ltunesco, 1969). It has both "walk-in" rooms and smaller "reach-in" cabinets where the phytotron staff performs all preparation, configuration and maintenance of the growth chambers or greenhouse units, and any routine plant care requested, including irrigation, fertilization and pest control. Staff members are present 24 hours a day to respond to any environmental control problems before they adversely affect experiments in progress. This staff has extensive experience in growing many species of native and agricultural from different habitats.

California Institute of Technology built the first phytotron under the direction of Frits Warmolt Went in 1949 and it was officially known as the Earhart Plant Research Laboratory, 1949.

Phytotrons have now spread around the world between 1945 and the present day to Australia, France, Hungary, the Soviet Union, England, India and the United States. Moreover, they have spurred variants such as the Climatron (uses controlled environment to recreate a lowland rain forest) at the Missouri Botanical Garden, the Biotron (provides controlled environments to support animal) at the University of Wisconsin-Madison, the Ecotron (precise conditioning of the environment and on line measurements of states and activities of organisms and ecosystems at various scales) at Imperial College London and the Brisatron (provides artificial conditions for aquatic species and reptiles) at the Savannah River Ecology Laboratory (Myers, 1983; Biotron, 2017; Munns, 2010).

In India, Indian Agriculture Research Institute (IARI), New Delhi established a National Phytotron Facility in 1997. It was the first facility of its kind in the country to study the live responses of plants under controlled environmental conditions and their possible impact on climatic change and greenhouse gases. It has a self-contained area of 2700 m^2, houses 22 growth chambers and 10 greenhouses. This facility is made available only for plant scientists belonging to ICAR (Indian Council of Agriculture Research), CSIR (Council of Scientific and Industrial Research),

SAUs (State Agriculture Universities), traditional universities and agro-industries to understand the complicated interaction of physiochemical environments and living systems, especially the plants and the pathogens (Anonymous).

Features of Phytotron

They provide state of the art programmer technology in the facility for preeminent control of the following conditions and with unequalled reliability and durability (Downs, 1980):

- Wide temperature and humidity ranges
- Accurate and reproducible results
- Choice of lighting systems
- Cost effective solutions
- High frequency fluorescent lighting
- Simple day/night control or advanced programmability
- Energy efficient lighting systems
- Multi day programming
- Multi-level password protection
- Graphical representation of the test values

Significance of Phytotrons

- Researchers are able to access world climatic conditions ranging from the Arctic to the Dessert to the Tropics while eliminating the variability found in nature because of this advent customised facility.
- It allows scientists to conduct experiments like complete life cycle of a plant or pests, transgenic studies under different climatic conditions to arrive at a conclusion.
- In educational institutes or research centres, scientists working on such parameters need different types of above mentioned facilities for conducting their research which they never find in as orderly form as in a Phytotron.
- Researchers can store all the data for the crop studies and can use the same for reference. Data can be saved/stored in numeric or graphical form. They can use the information in different combinations as per his requirements.

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