WELCOME

Lecture on

Climate control in greenhouse

by

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Climate control in greenhouse

- The control of climate inside greenhouse means control of temperature, light, humidity, CO2 and soil medium etc.

Climate control in greenhouse:-

(1.) Manual controlling

(2.) Thermostats

(3.) Active summer cooling system

(A) Fan and Pad cooling system

(B) Fog cooling system

(4.) Active winter cooling system

(A) Convection tube cooling

(B) Horizontal air flow cooling

(1.) Manual Controlling-

- During the half of the 20 century, it was common for greenhouse firms to employ a night watch person to regulate temperature.

- This person made periodic trips through greenhouse during night, checking the temperature in each greenhouse and controlling it by opening or closing valves of heating pipes are required.

- During the day, employees opened or closed ventilators by hand to maintain temperature.

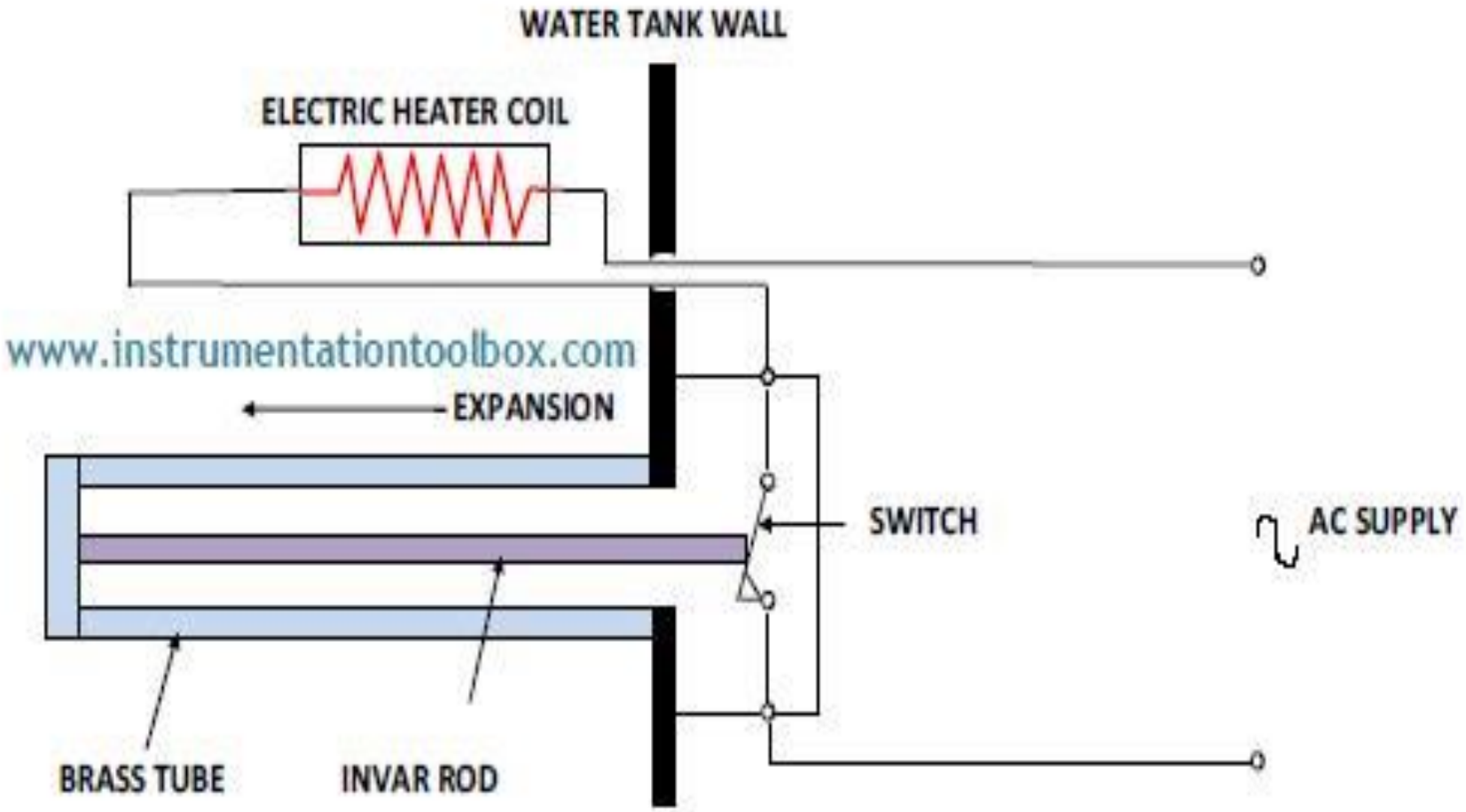
- Hence temperature had to be manually controlled throughout the day during cropping season.

- The success of manual control based on skill experience of person.

(2.) Thermostats-

❖ Thermostat is a automatic device which senses the temperature and activate / deactivates the attached equipment, with reference to set a temperature.

❖ It may use of a bimetallic strip or thin metal tube filled with liquid or gas as sensor and it produced some physical displacement according to sensed temperature.



Thermostats

(3.) Active summer cooling system-

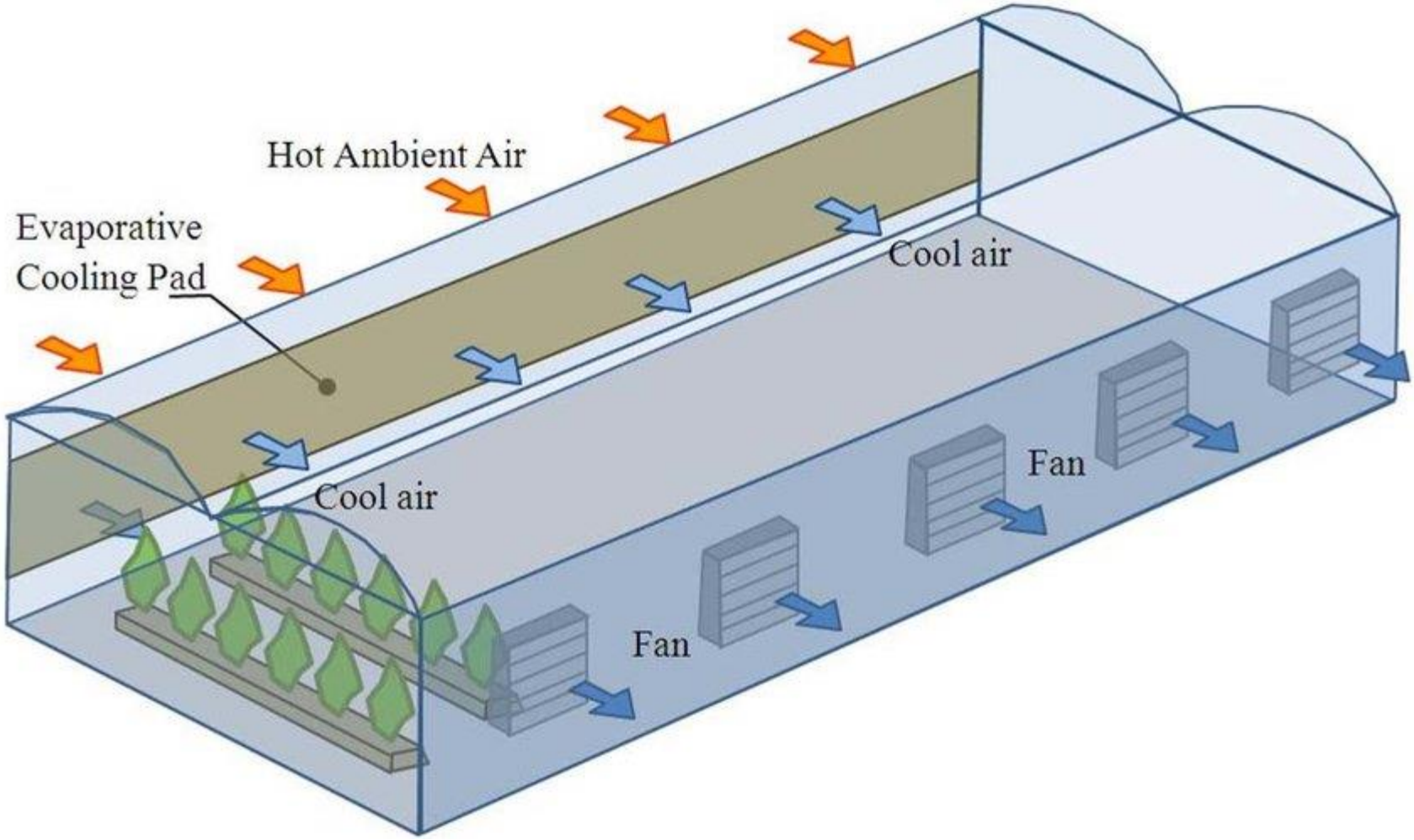
Active summer cooling achieved by evaporation cooling process evaporative cooling system developed to reduce excess heat in greenhouse. Its tow types-

(A) Fan and Pad cooling system-

✓ In this method one side wall of greenhouse water is passed through pad usually vertically in wall made of cellulose material similar appearance to corrugated card board box.

✓ Exhaust fans are placed on opposite wall then warm air exit outside through pad.

✓Wet pad absorb heat from greenhouse, air pass through outside fan cooling effect.



Fan and Pad cooling system

(B) Fog cooling system-

✓The fog cooling system based on some cooling principle as fan and pad system but arrangement is different.

✓A high pressure pumping apparatus generates fog containing water droplets with size of 10 micron using nozzle.

✓The droplets are sufficiently small to stay suspended in air *i.e.* fog dispersed through the greenhouse cooling air everywhere.

✓This system not wet foliage so there is less scope for disease and insect attack.

Fog cooling system

(4) Active winter cooling system-

- During winter excess heat is problem for maintaining heat in greenhouse than extrapment of solar heat rise inside temperature.
- The actual process of winter cooling is the mixing of low temperature ambient air with warm inside air, which cools the greenhouse environment. Two active winter cooling system-

(a) Convection tube cooling

(b) Horizontal air flow cooling

(A) Convection tube cooling-

- The convection tube cooling are louvered air inlet, a polyethylene connection tube with air distribution holes, a pressurizing fan direct air into the tube under pressure and an exhaust fan to create vacuum.
- When the air temperature inside greenhouse exceed the set point, the exhaust fan starts functioning thus creates vacuum inside greenhouse.
- The pressuring fan at the end of clear polyethylene convection tube, operated to pick up cool air entering the lover.
- Cold air mixes with warm greenhouse air above the plant height.

- The cooled mixed air, bring heavier gently flows down to floor level effects the complete affect the complete cooling of the plant area.
- When cooling is not required, the inlet louver closes and the pressurizing fan continue to circulate the air within the greenhouse. This process minimized the temperature gradient at different level.

(B) Horizontal air cooling-

- It use small horizontal fans for moving the air mass and is considered to be an alternative to convection tube for the year distribution.
- In this method, the greenhouse may be visualized as a large box containing air and fans located strategically moves the air in a circular pattern.

- The horizontal air flow system makes use of the same exhaust fans, inlet louvers and control as the convection tube system.

(C) Carbon dioxide enrichment method:

1. Production of carbon gas by burning method- in this method the natural oil, puffin oil and kerosene are burned and produce CO_2 gas which is utilized in greenhouse.

2. Liquid carbon dioxide- under certain pressure CO_2 gas can be converted into liquid form and passed inside greenhouse using regulating valve.

3. Solid CO_2 (also called dry ice)- under high pressure and low temperature CO_2 gas can be converted into solid i.e. dry ice. By using it can increase CO_2 level in the greenhouse.

Light control-

✓ For photosynthetic activities of plant, light are essential. Primary, the three component of sun rays are important i.e. light intensity, light frequency and light period.

✓Greenhouse crops are subjected to light intensity as high as 120 k lux on clear summer days to below 3.2k hours on cloudy winter days. It is primarily the visible spectrum of light that is used for photosynthesis i.e. 400 to 700 mm wavelength range.

✓In the black and red bands of visible spectrum photosynthetic activity is higher than the blue light (short wavelength) alone is supplied to plant , the growth is retarded and plant become hard and dark in colour.

✓When plant are grown under red light (longer wavelength), growth is soft and internodes are long resulting in tall plants.