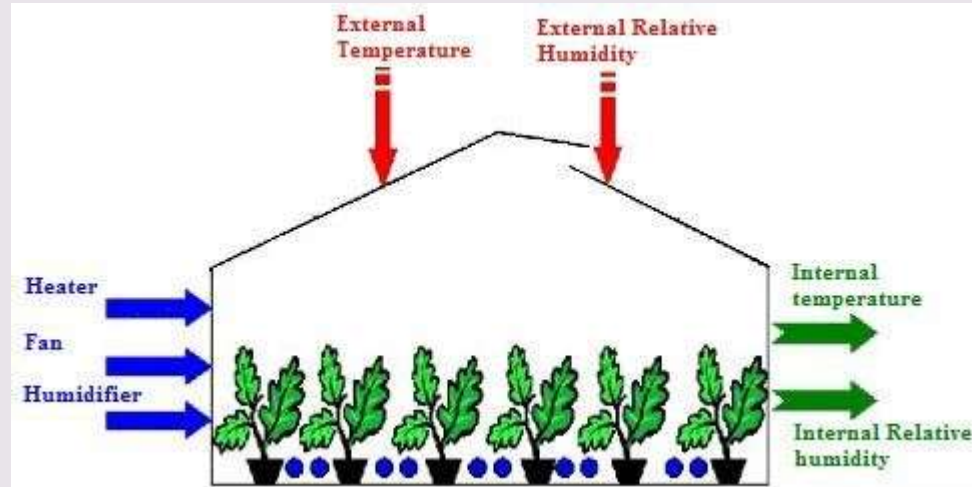




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Center for Smart Agriculture

Protected floriculture



Module 2: : Components Pre-requisites for protected cultivation of flower crops

Session 9: Plant response to greenhouse environments



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Introduction

- The productivity of a crop is influenced not only by its heredity but also by the microclimate around it. The components of crop microclimate are light, temperature, air compositions and the nature of the root medium. In open fields, only manipulation of nature of the root medium by tillage, irrigation and fertilizer application is possible. The closed boundaries in greenhouse permit control of any one or more of the components of the micro climate.



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Light

- Green house crops are subjected to light intensities varying from 129.6 klux on clear summer days to 3.2 klux on cloudy winter days.
- Many crops become light saturated, in other words, photosynthesis does not increase at light intensities higher than 32.2klux. In general, for most other crops foliage is deeper green if the greenhouse is shaded to the extent of about 40% from mid spring (May) to mid fall (August and September). Thus, it is apparent that light intensity requirements of photosynthesis are vary considerably from crop to crop.



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- Not all light useful in photosynthesis process. It is primarily, the visible spectrum of light that is used in photosynthesis.
- In the blue and red bands, the photosynthesis activity is higher, when the blue light (shorter wavelength) alone is supplied to plants, the growth is retarded, and the plant becomes hard and dark in colour.
- When the plants are grown under red light (longer wavelength), growth is soft and internodes are long, resulting in tall plants. Visible light of all wavelengths is readily utilized in photosynthesis.



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Temperature

- Temperature is a measure of level of the heat present. All crops have temperature range in which they can grow well. Below this range, the plant life process stop due to ice formation within the tissue and cells are possibly punctured by ice crystals.
- At the upper extreme, enzymes become inactive and again process essential for life cease. The rate of reactions controlled by the enzyme often double or triple for each rise of temperature by 10°C , until optimum temperature is reached. Further, increase in temperature begins to suppress the reaction and finally stop it.



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- As a general rule, green house crops are grown at a day temperature, which are 3 to 6⁰C higher than the night temperature on cloudy days and 8⁰C higher on clear days.
- The night temperature of greenhouse crops is generally in the range of 7 to 21⁰C. Primula, mathiolaincana and calceolaria grow best at 7⁰C, carnation and cineraria at 10⁰C, rose at 16⁰C, chrysanthemum and poinsettia at 17 to 18⁰C and African violet at 21 to 22⁰C.



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Relative humidity

- In order to maintain the desirable relative humidity levels in the green houses, processes like humidification or dehumidification are carried out. For most crops, the acceptable range of relative humidity is between 50 to 80%. However for plant propagation work, relative humidity up to 90% may be desirable.
- In summer, due to addition of more sensible heat cause a reduction in the relative humidity of the air. For this purpose, evaporative cooling pads and fogging system of humidification are employed. When the relative humidity is on the higher side, ventilators, humidifiers and cooling coils are used for de- humidification.



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Ventilation

- A greenhouse is ventilated for either reducing the temperature of the green house air or for replenishing carbon dioxide supply or for moderating the relative humidity of the air.
- Air temperatures above 35°C are generally not suited for the crops in green house. It is quite possible to bring the green house air temperature below this upper limit during spring and autumn seasons simply by providing adequate ventilation to the green house.



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- The ventilation in a greenhouse can either be natural or forced.
- In case of small green houses (less than 6m wide) natural ventilation can be quite effective during spring and autumn seasons. However, fan ventilation is essential to have precise control over the air temperature, humidity and carbon dioxide levels.



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Carbon dioxide

- During the day, when photosynthesis occurs under natural light, the plants in a greenhouse draw down the level of CO₂ to below 200 ppm. Under these circumstances, infiltration or ventilation increases carbon dioxide levels, when the outside air is brought in to maintain the ambient levels of CO₂.
- If the level of CO₂ is less than ambient levels, CO₂ may retard the plant growth. In cold climates, enrichment of the green house with CO₂ is followed.



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- The exact CO₂ level needed for a given crop will vary, since it must be correlated with other variables in greenhouse production such as light, temperature, nutrient levels, cultivar and degree of maturity.
- Most crops will respond favourably to CO₂ at 1000 to 1200 ppm.



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THANK YOU